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Central Puget Sound
Regional Fare Coordination System

CDRL 13 - PT Installation Procedure - MCI High Floor Bus Relocated WDOLS

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1 Introduction

This installation procedure for the MCI High Floor Bus with relocated WDOLS at Pierce Transit (PT) shows installation technician(s) where and how to mount devices that are part of the Regional Fare Coordination System (RFCS) and install the cabling required to assure correct and reliable system operation. To make best use of the illustrations, this manual should be printed in color.

These six devices are to be installed:

- **The On-Board Fare Transaction Processor (OBFTP):** This is the master device in the system. It contains the smart card reader and is the interface to the customer.
- **The Driver Display Unit (DDU):** This is the bus operator’s interface with the system. It is used to input passenger counts, route information, and other data. It also displays messages for the operator. This device comes with a mounting cradle designed to be mounted on the bracket provided by PT.
- **The Wireless Data On/Off Loading System (WDOLS):** This device changes the data from a Category 5 input to a 2.4-GHz wireless signal and vice versa. There are two parts to the WDOLS system:
    - The Power Injector: Both the Ethernet and the power cables plug into this unit’s input ports. The output of this unit powers the Cisco 1310 Bridge/Access Point.
    - The Cisco 1310 Access Point/Bridge: The power injector cables plug into the input ports of this unit. The antenna plugs directly to the output port of the unit as a reverse threaded Neil-Concelman (TNC) connector.
- **The Antenna:** An upgraded external antenna is fitted to the WDOLS unit to allow an omni-directional signal to be transmitted and received.
- **The Ethernet Switch:** This small device acts as a junction for the three Category 5 cables that come from the OBFTP, the DDU, and the WDOLS. These devices are connected using Category 5 cabling.
- **The Load Dump Module (LDM):** This device protects the equipment from voltage transients and spikes that may be caused by the bus electrical system.

1.1 Purpose

This installation guide describes the positions and methods of mounting the devices on the MCI High Floor Bus with the WDOLS installed in the Radio box. It shows how and where the required cabling should be installed for correct and reliable operation.

1.2 Scope

Please note that the following disclaimer describes the scope of this document:

DISCLAIMER: The material in this installation guide is provided as a preliminary guide for Agency participants of the RFCS and is for information purposes only. The material provided in this document is not intended, and should not be relied upon, for installation purposes. ERG does not guarantee the accuracy or completeness of any material in this document or in the photos displayed herein, nor shall ERG be liable in any way to the user or recipient of the data, material herein, or to any other person for any delays, inaccuracies, errors in, or omission of any such material, guidelines, instructional data herein or the transmission thereof, or for any actions taken in reliance thereon or for any damages arising therefrom. Bidders or recipients of the Agencies' Request for Proposal (RFP) are reminded that this information has been provided to the Agencies in preliminary draft format and should not be relied upon for installation instruction or as a complete instruction for meeting the requirements under this solicitation and/or RFP.

1.3 Overview

The locations and photographs in this guide depict the following:

- Where and how to mount the equipment
- The location of attachment points for power
- Details on cable routing

1.4 Acronyms and Abbreviations

This section contains a list of acronyms and abbreviations used in this document.

Table 1 contains the acronyms and abbreviations that are specific to ERG. Industry-standard acronyms and abbreviations are not defined in this table.

Table 1: Acronyms and Abbreviations

Acronym or Abbreviation	Definition
DDU	Driver Display Unit
LDM	Load Dump Module
OBFTP	On-Board Fare Transaction Processor
PT	Pierce Transit
RFCS	Regional Fare Coordination System
TNC	Threaded Neill-Concelman, a threaded version of the bayonet Neil-Concelman (BNC) Type C RF connector
WDOLS	Wireless Data On/Off Loading System

1.5 References

[1] Contract 229944, as amended and conformed

[2] SEA-02088 Generic On-Board Installation Instruction

2 Installing the Devices

There are two different installations for the MCI buses at PT. This document covers the installation where the WDOLS is installed in the outside panel in the radio box only. The DDU and OBFTP mounting is the same between the coaches. However, the WDOLS has been relocated and the cable routes have been changed.

2.1 Mounting the DDU

The DDU mounts to an adjustable bracket which is attached to the vertical panel of the dash (see Figure 1). The DDU cables exit the bottom of the DDU cradle and run through conduit through holes in the flat dash panel.

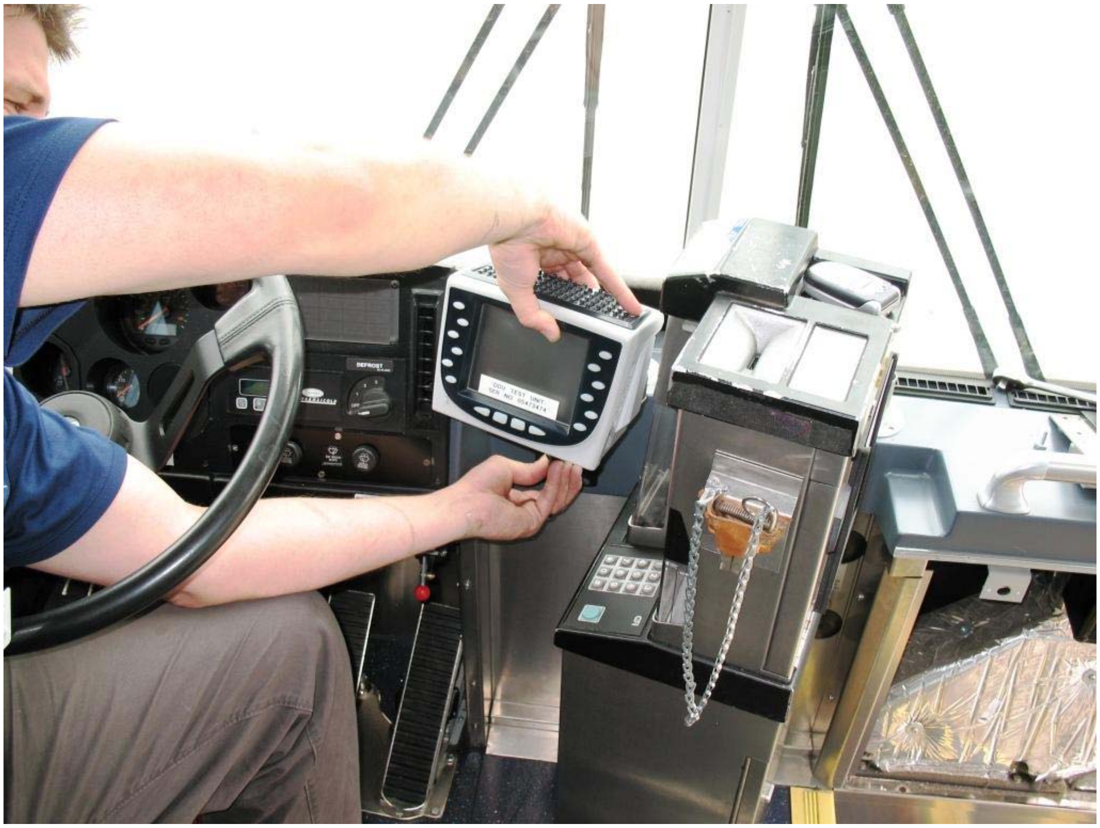

Figure 1: DDU Location

1. Position the bracket on the dash at the location shown in Figure 2. The bracket holes must be on either side of the seam in the dash. The bracket is centered along the seam and is mounted two inches from the top of the dash.
2. Carefully mark the holes for drilling.
3. Drill four 5/16-inch holes for nutserts, using pilot drill as needed.
4. Fit the nutserts to the dash.
5. Mount the DDU bracket using four ¼-inch x 20 bolts.

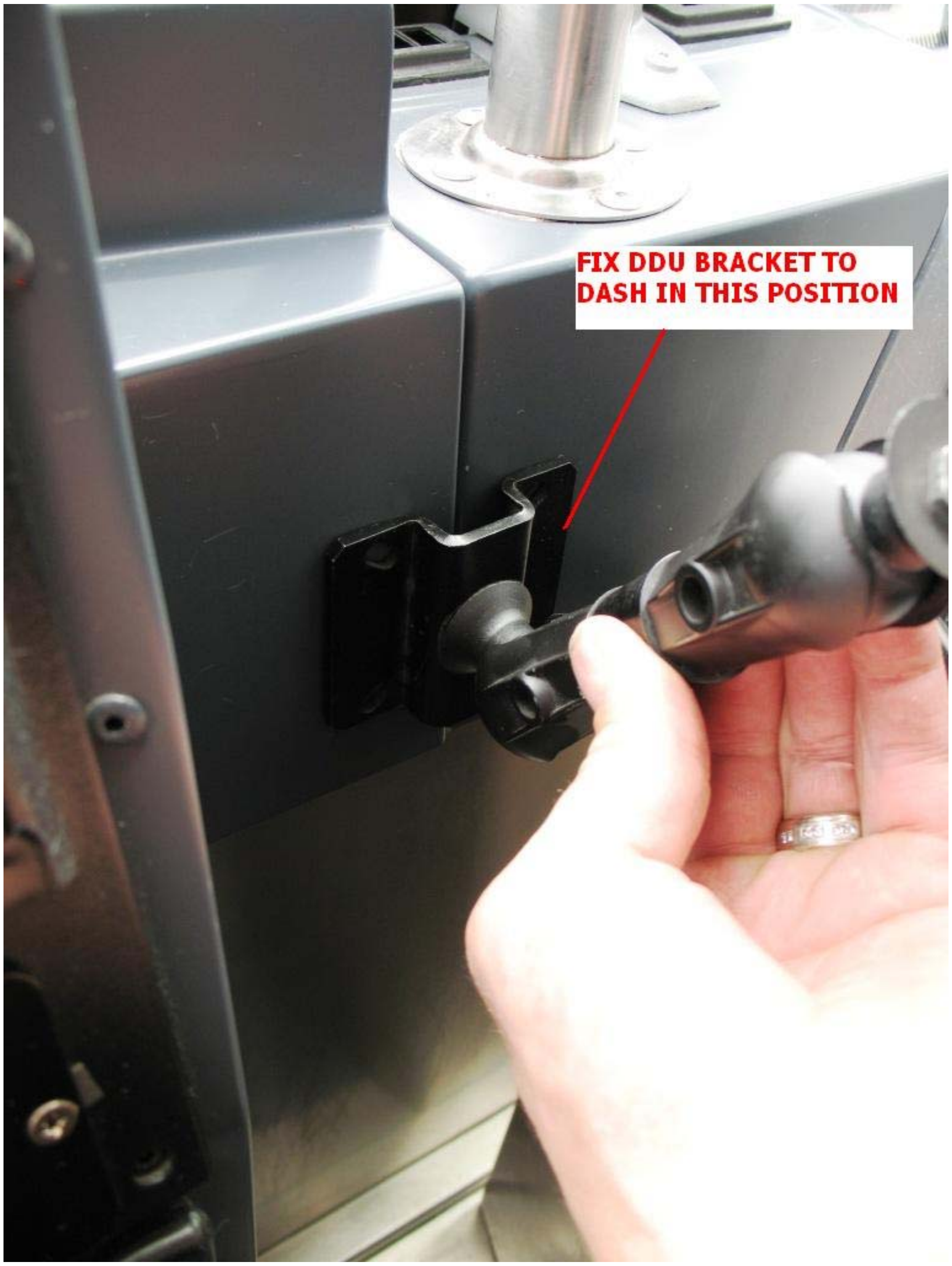

Figure 2: Mounting Position of DDU Bracket

6. Set the DDU cradle on the pre-drilled DDU bracket top plate (see Figure 3).
7. Secure the DDU cradle to the top plate with three M5x20-mm screws and nyloc nuts. Ensure true and secure fitment of the cradle to the plate.
8. Place the DDU onto the DDU cradle as shown in Figure 1. Lock the DDU to the cradle using the key provided.

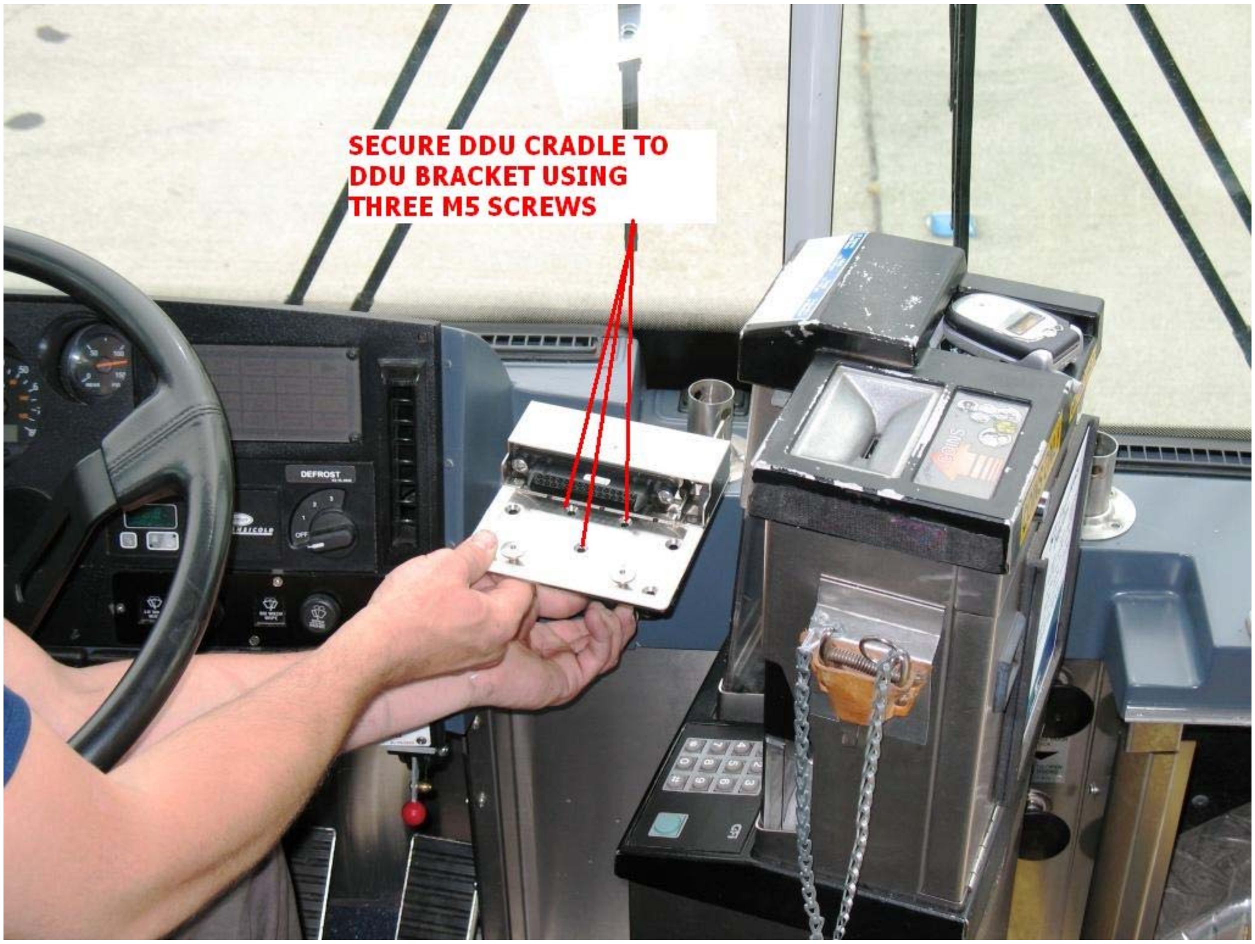

Figure 3: DDU Mounting Bracket

2.2 Mounting the OBFTP

The OBFTP mounting position and method is on the right-hand side of the passenger boarding the bus (see Figure 4). The OBFTP bracket is fixed to a vertical stanchion, which is secured to a base clamp. The base clamp is fixed to the dash using four bolts, nuts, and fender washers. The cabling for the device runs through the vertical stanchion and base clamp into the dash cavity.

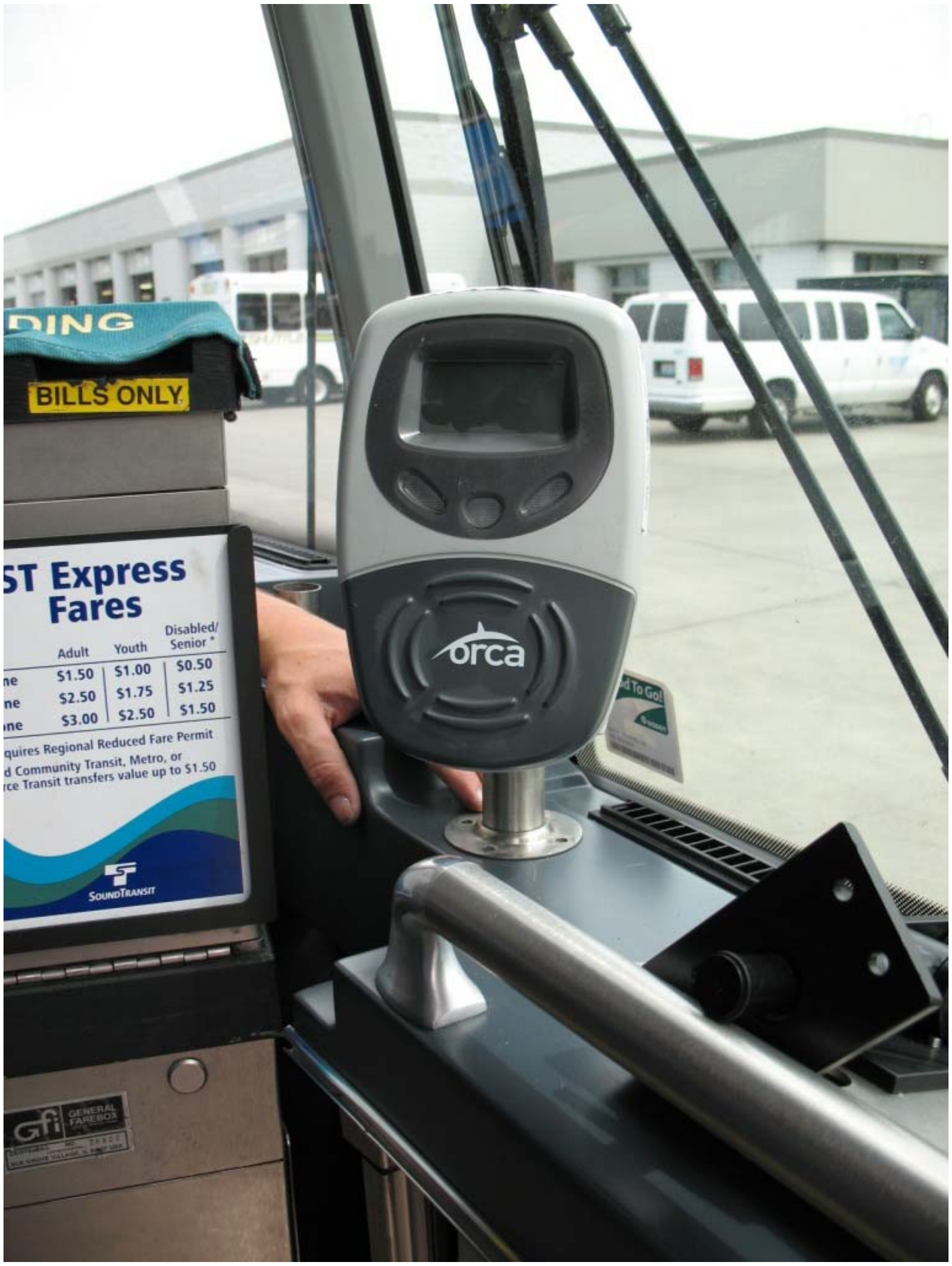

Figure 4: OBFTP Location

1. Remove the center locating screw from the OBFTP bracket. Insert a 7-inch vertical stanchion into the base clamp until it won’t go any farther. Fit the OBFTP bracket to the vertical stanchion. The bottom of the OBFTP bracket should touch the top of the base clamp, i.e., the OBFTP bracket should sit as low on the stanchion as possible.
2. Mark the location of the hole for the locating screw to bolt into the stanchion by punching a mark through the hole as shown in Figure 5.

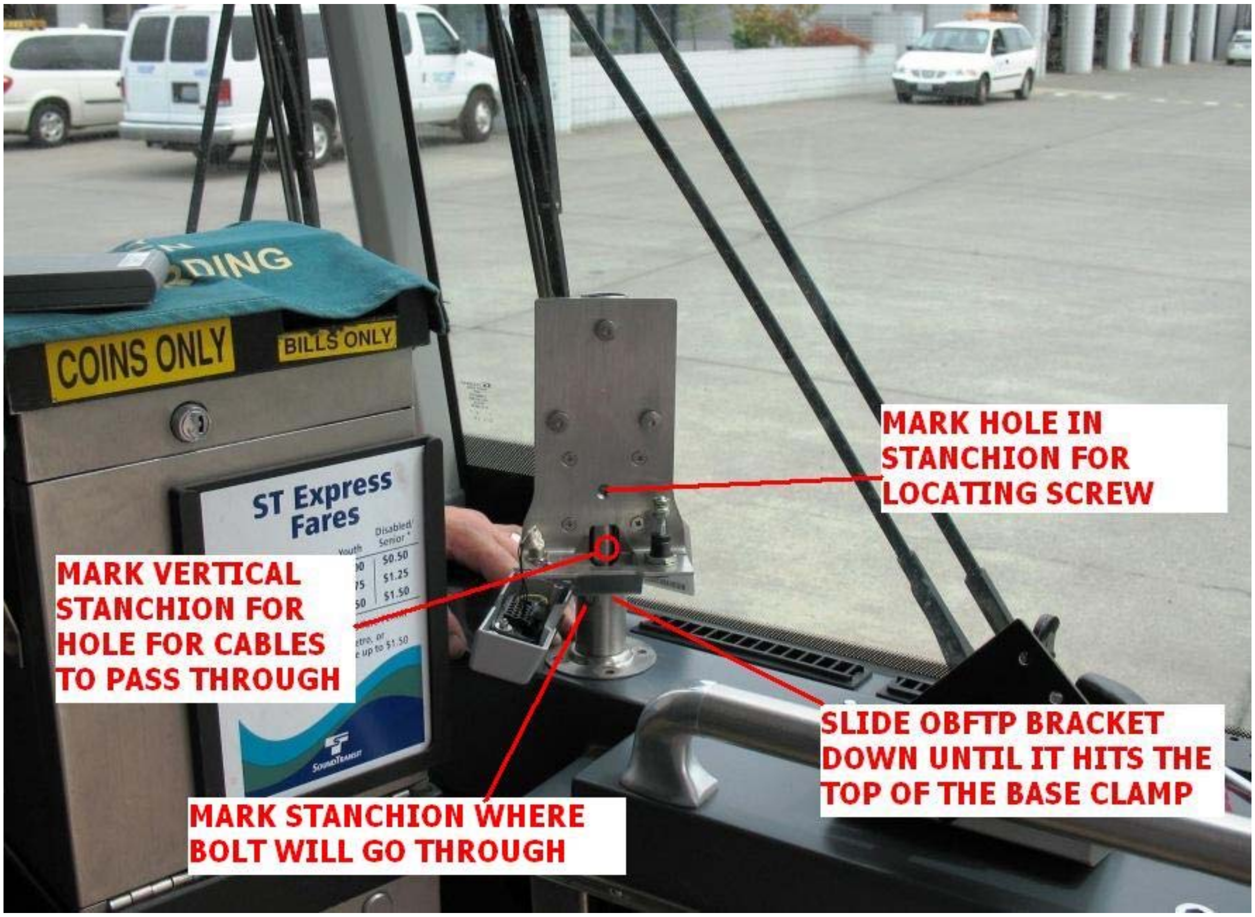
MARK HOLE IN STANCHION FOR LOCATING SCREW
MARK VERTICAL STANCHION FOR HOLE FOR CABLES TO PASS THROUGH
SLIDE OBFTP BRACKET DOWN UNTIL IT HITS THE TOP OF THE BASE CLAMP
MARK STANCHION WHERE BOLT WILL GO THROUGH
COINS ONLY
BILLS ONLY
ST Express Fares

Figure 5: OBFTP Mounting Bracket Detail

3. Mark the location for the hole for the cable to exit the vertical section and enter the OBFTP bracket by punching a mark in the center of the cutout of the bracket.
4. Mark the hole in the stanchion for the bolt to go through.
5. Remove the vertical stanchion from the base clamp. Position the base clamp on the dash panel as shown in Figure 6.
6. Mark four holes in the dash for bolts. Mark the hole in center of the base clamp for the cables to pass through into the dash as shown in Figure 6.

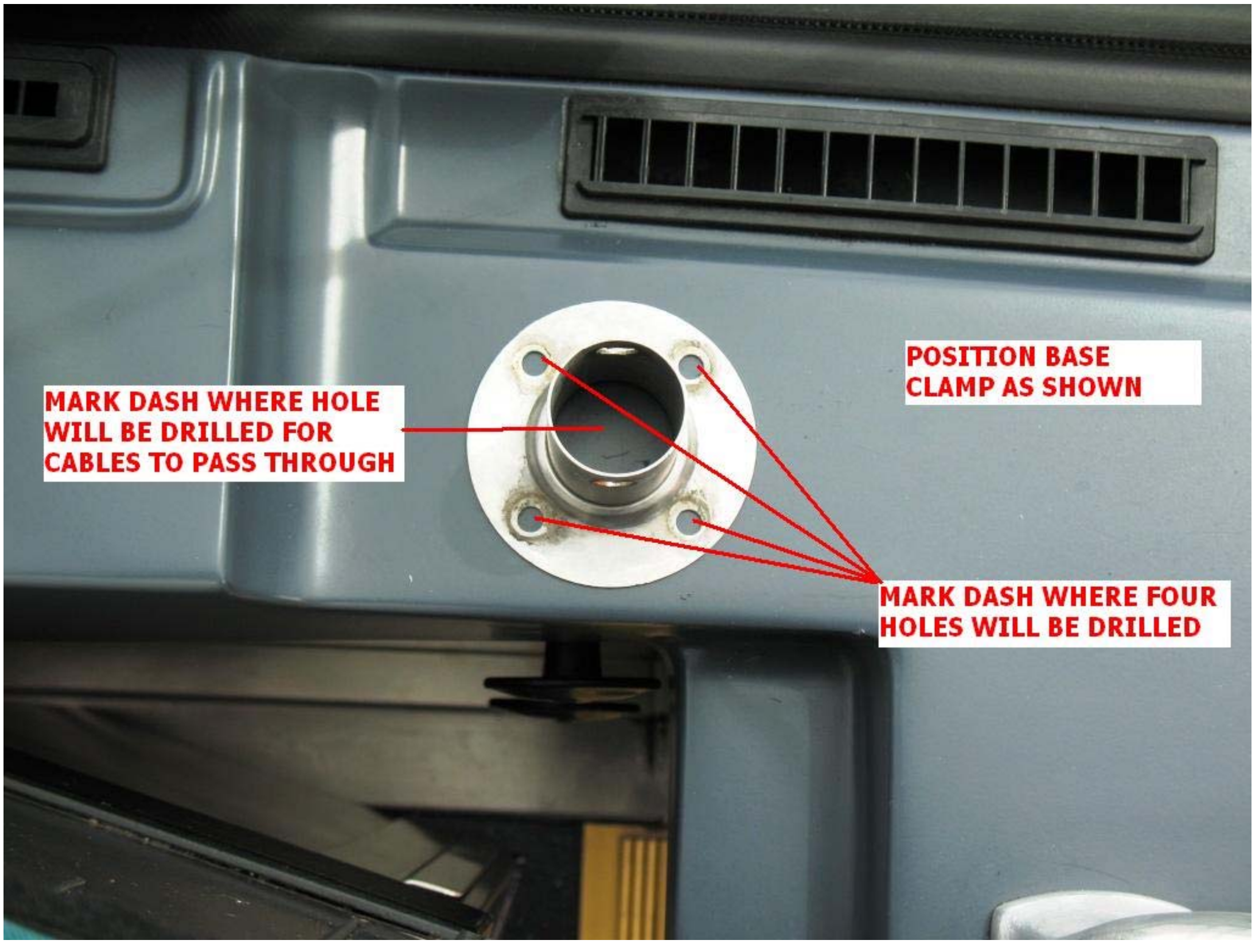
MARK DASH WHERE HOLE WILL BE DRILLED FOR CABLES TO PASS THROUGH
POSITION BASE CLAMP AS SHOWN
MARK DASH WHERE FOUR HOLES WILL BE DRILLED

Figure 6: Base Clamp Hole Location Detail

7. Drill the required holes:
    a. Drill a 7/32-inch hole through the vertical stanchion for the locating screw.
    b. Drill a 3/4-inch hole in the bottom of the vertical stanchion where indicated to allow cables to pass through into the OBFTP cradle. De-bur the hole and insert the grommet edging provided.
    c. Drill a 3/4-inch hole through the bottom of the dash to allow cables to enter the dash cavity. De-bur the hole and insert the grommet edging provided.
    d. Drill a 3/8-inch hole in the vertical stanchion for the base clamp through bolt.
    e. Drill four ¼-inch holes for bolts to mount the base clamp to the dash.
8. Fit the vertical stanchion to the base clamp as shown in Figure 5.
9. Secure the base clamp to the dash using four ¼-inch X 20 bolts, fender washers, and nyloc nuts.
10. Fit the OBFTP clamping bracket to the vertical stanchion as shown in Figure 5. Tighten the four Philips screws that hold the clamp in place and fit the locating screw to secure the unit.

Note: Do not assemble the vertical stanchion assembly or the OBFTP bracket until cabling to the OBFTP bracket is complete. See cabling procedures in Section 3.

11. Fit the OBFTP to the OBFTP bracket as shown in Figure 4 and secure the device using the key provided.

2.3 Mounting the WDOLS, Ethernet Switch, and Antenna

2.3.1 Mounting the WDOLS and Ethernet Switch to an Aluminum Plate

The WDOLS and the Ethernet Switch are mounted on an aluminum plate to allow for ease of installation. This plate is manufactured by PT and has standoffs in place for the devices to be mounted.

Note: The picture (see Figure 7) is an example only and not the actual installation.

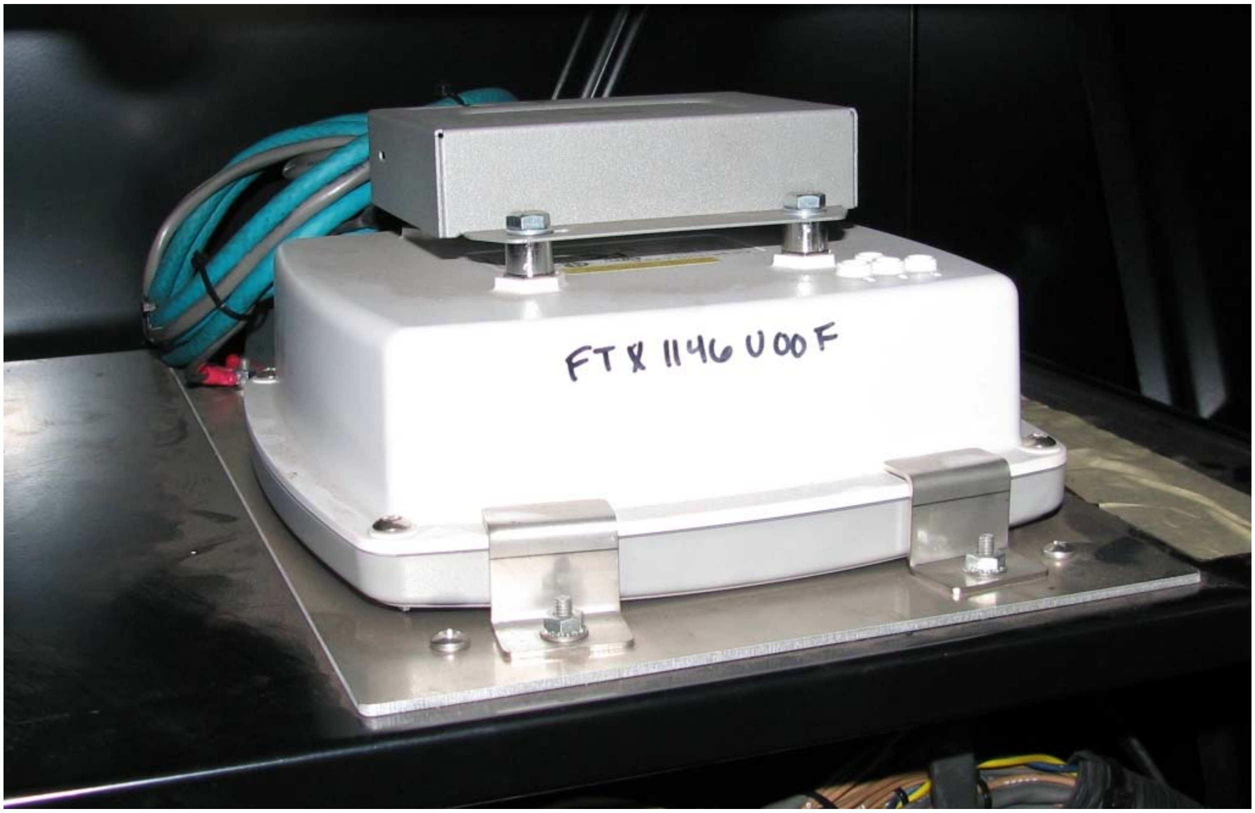

Figure 7: Close-up of Ethernet Switch and WDOLS Mounting Plate

1. Position the Ethernet Switch and WDOLS on plate as shown in Figure 8.
2. Mount the Ethernet Switch to the plate using three lock nuts.
3. Mount the WDOLS to the plate using four Z-clamps which are secured to the plate using four lock nuts.
4. Mount the Cisco power injector to the WDOLS using four M6x10 hex head bolts and flat washers.
5. Fit the cable connecting the Cisco power injector to the WDOLS.
6. The aluminum plate assembly is now ready to be mounted in the bus. The aluminum plate that holds WDOLS and Ethernet Switch is mounted in the radio box in the outside panel and is mounted to the lowest tray as shown in Figure 8.

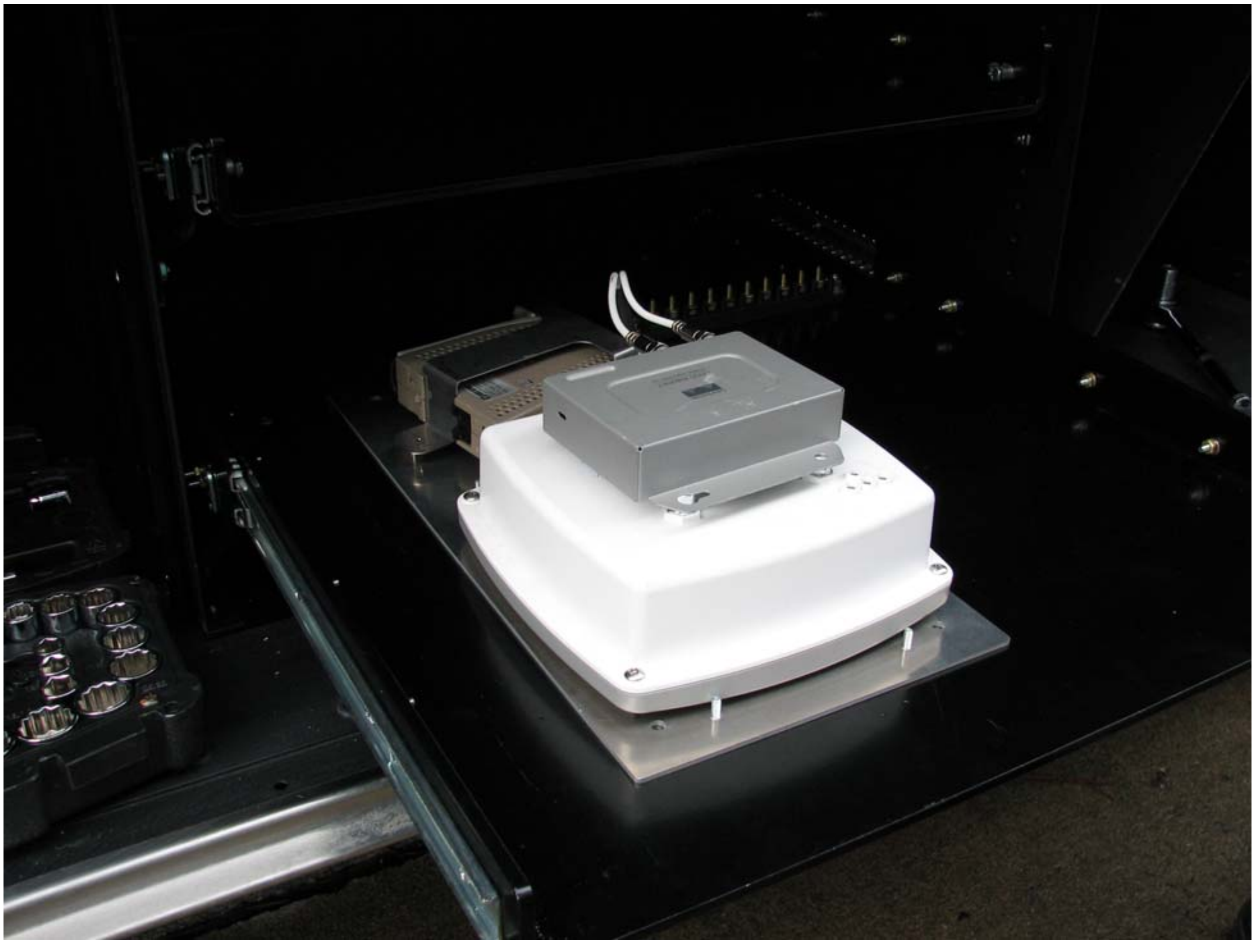

Figure 8: WDOLS/Ethernet Switch Aluminum Plate Location

2.3.2 Mounting the WDOLS and Ethernet Switch Plate Assembly

1. Position the plate with the devices in place on the panel.
2. Mark holes for machine screws to secure the plate to the tray.
3. Secure the aluminum plate to the tray using screws, flat washers, and nyloc nuts.

2.3.3 Mounting the Antenna

Mount the antenna on the roof of the bus. There is a panel in the luggage compartment, see Figure 9. Remove this panel to access the roof of the bus.

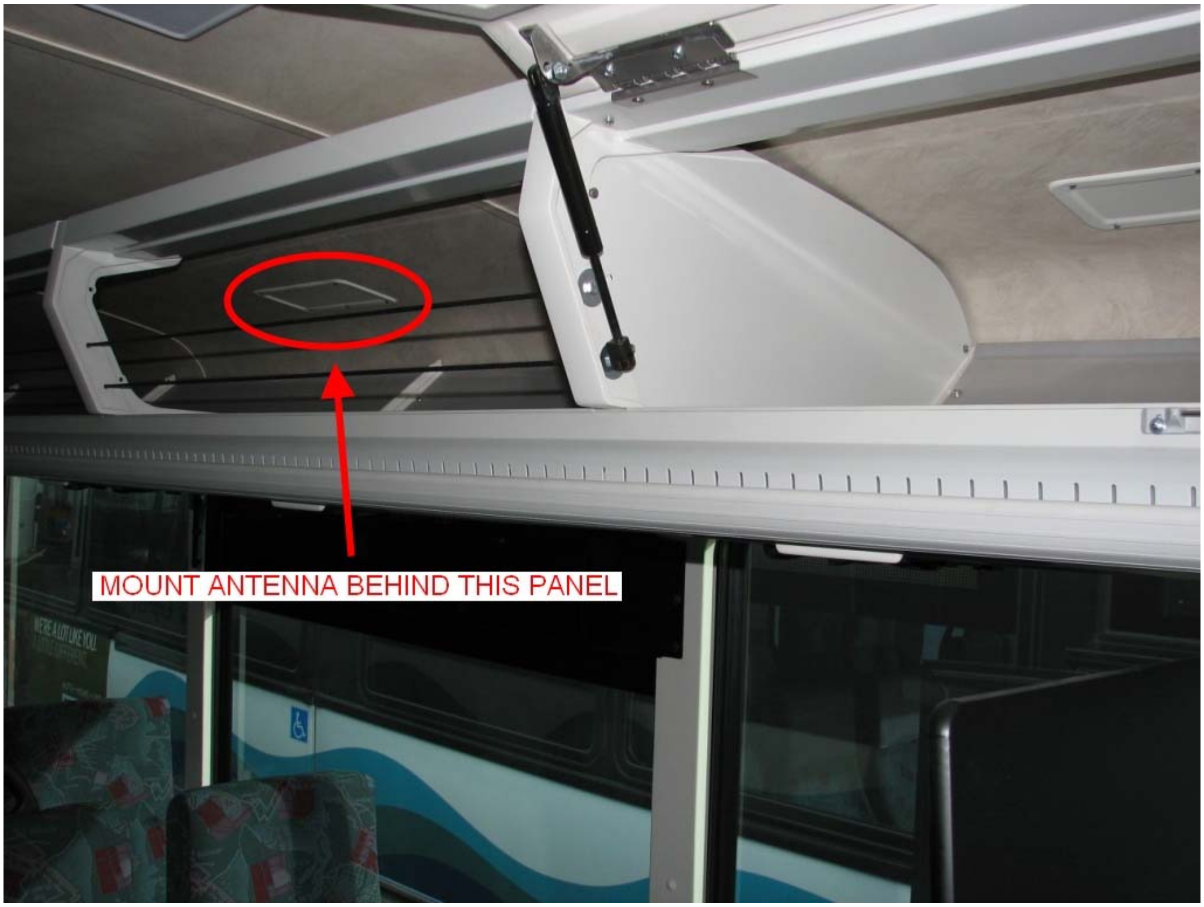

Figure 9: External Antenna Location

1. Remove the six screws holding the access panel in place.
2. Carefully mark a hole in the roof. Drill a 5/8-inch hole through the roof of the bus. Use a pilot drill where necessary.
3. From the roof of the bus, de-bur the hole with a de-burring tool or round file. Insert the antenna cable through the hole and feed through until the antenna sits firmly against the roof. Ensure that the rubber seal is intact. Seal the antenna using appropriate sealer.
4. Slide the lock washer and then the nut over the cable end and run along the cable to the antenna thread. Tighten the nut.

2.4 Mounting the LDM

The LDM is secured by two screws.

1. Position the LDM as shown in Figure 10. The LDM mounts to the metal panel.
2. Drill two 3/16” holes in the panel and mount the LDM with the two 10/32 x 1 ¾” machine screws.

IMPORTANT: MAKE SURE NO METAL SHAVINGS/FRAGMENTS ARE PRESENT AFTER DRILLING.

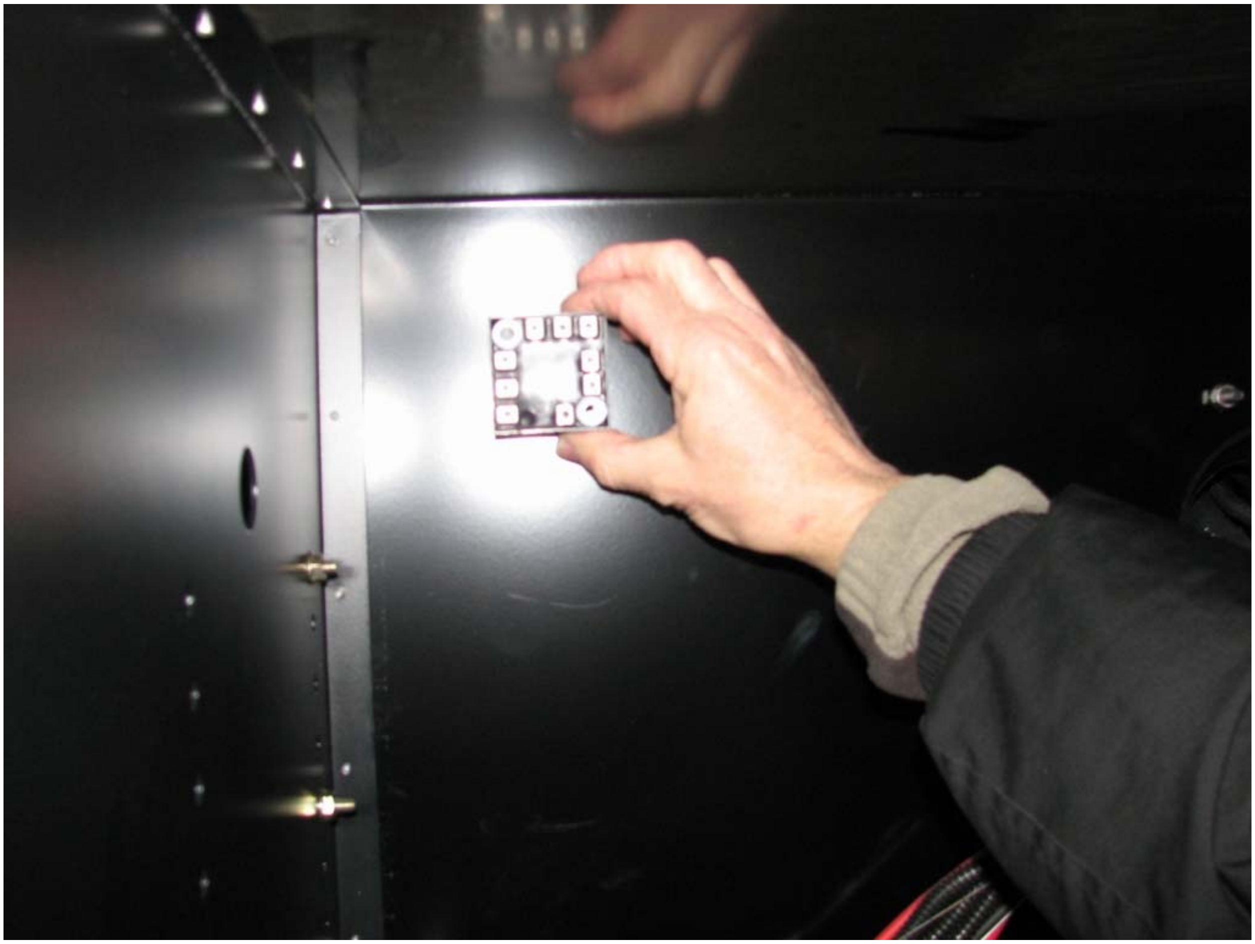

Figure 10: LDM Location and Mounting Detail

3 Installing the Cables

The following cable types and lengths are needed for each bus:

Power Cable Lengths:

Circuit Breakers to LDM	15 ft.
DDU to LDM	29 ft.
OBFTP to LDM	30 ft.
WDOLS to LDM	4 ft.

Ethernet Cable Lengths:

DDU to Ethernet Switch	32 ft.
OBFTP to Ethernet Switch	33 ft.
WDOLS to Ethernet Switch	3 ft.
Ethernet Shield Lengths	6 in.

Antenna Cable Length:

Antenna Cable Length	30 ft.

Power for the devices is drawn from the power distribution panel on the driver’s side of the vehicle.

3.1 Cabling the Circuit Breaker and LDM

Two circuit breakers are fitted to the bus. One breaker is fitted to the constant (unswitched) +24-V rail and the other breaker is fitted to the ignition (switched) +24-V rail. Figure 11 shows where the circuit breakers are mounted to steel panel.

Figure 12 shows where the power is taken from existing power studs to supply power to the LDM. The LDM is located in the Radio Box. Power for the DDU, OBFTP, WDOLS, and Ethernet Switch is taken from the LDM. Ground is taken from the appropriate grounding strip in Figure 12.

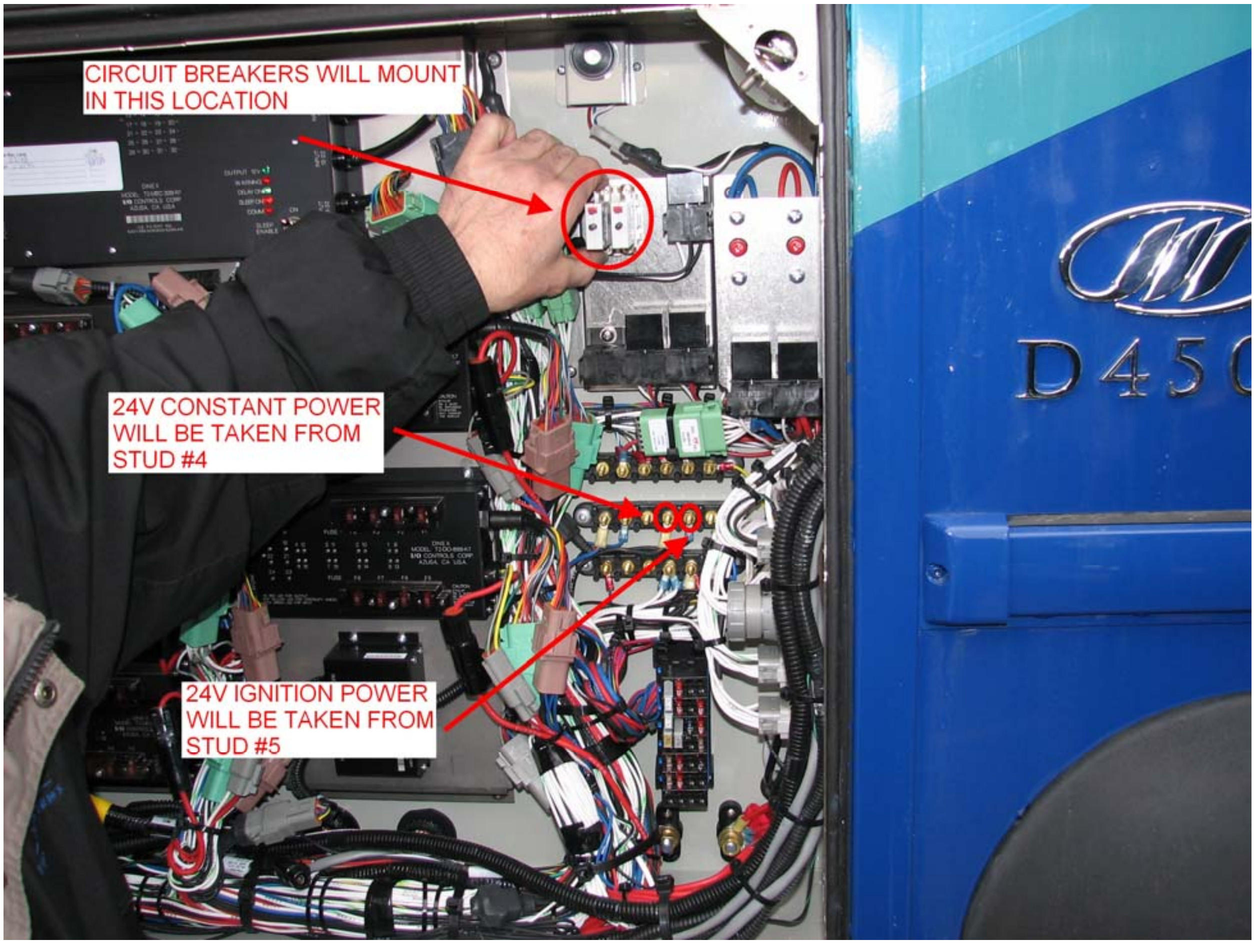
CIRCUIT BREAKERS WILL MOUNT IN THIS LOCATION
24V CONSTANT POWER WILL BE TAKEN FROM STUD #4
24V IGNITION POWER WILL BE TAKEN FROM STUD #5
D450

Figure 11: Circuit Breaker and Power Detail

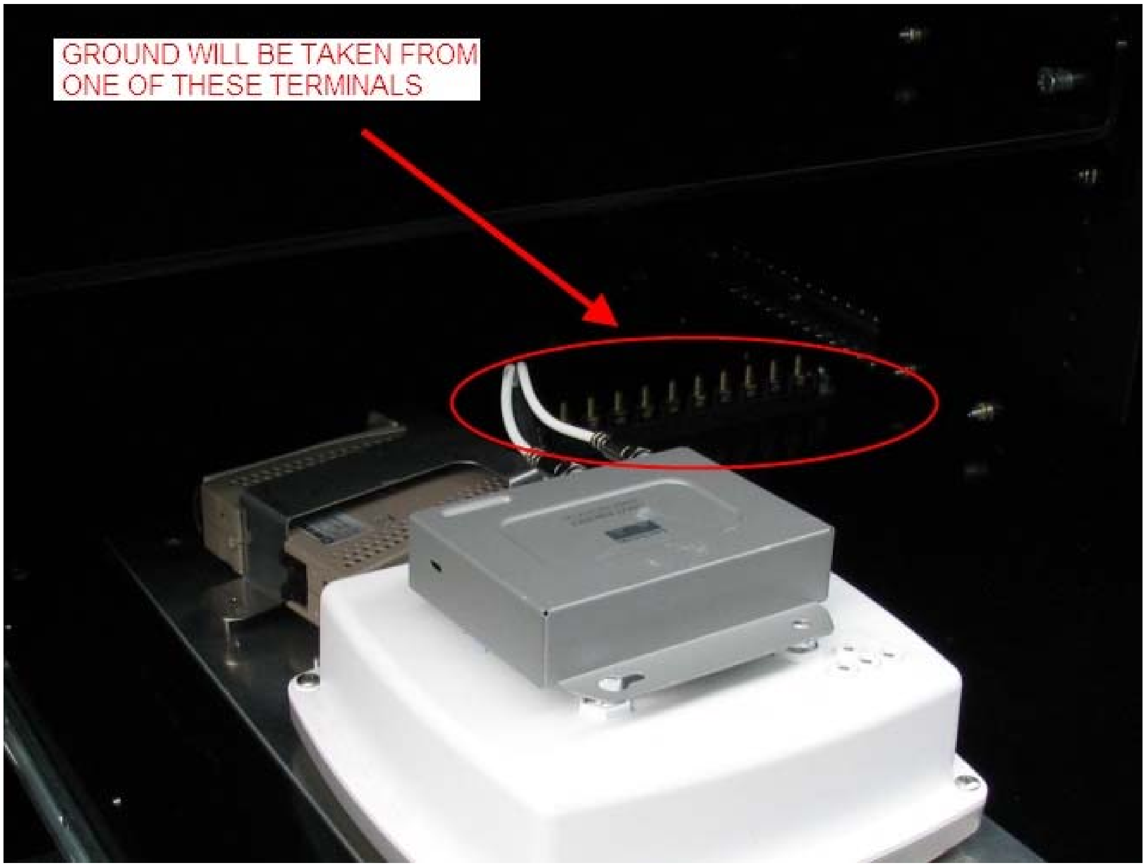

Figure 12: Power Connections - Detail

1. Locate the position of the circuit breaker mounting block and mark holes for two screws. Drill two pilot holes with a 9/64" drill in the plate and install the mounting block with two #10 self-tapping screws.

IMPORTANT: MAKE SURE NO METAL SHAVINGS/FRAGMENTS ARE PRESENT AFTER DRILLING.

2. Once the circuit breakers are mounted, install the power cables as shown in Figure 11. Constant power will be run to the 4 Amp breaker and switched power will be run to the 1 Amp breaker.
3. Run the power cable from the circuit breakers to the LDM and terminate the cable with ring terminals. Attach the cables to the LDM as shown in Figure 13.

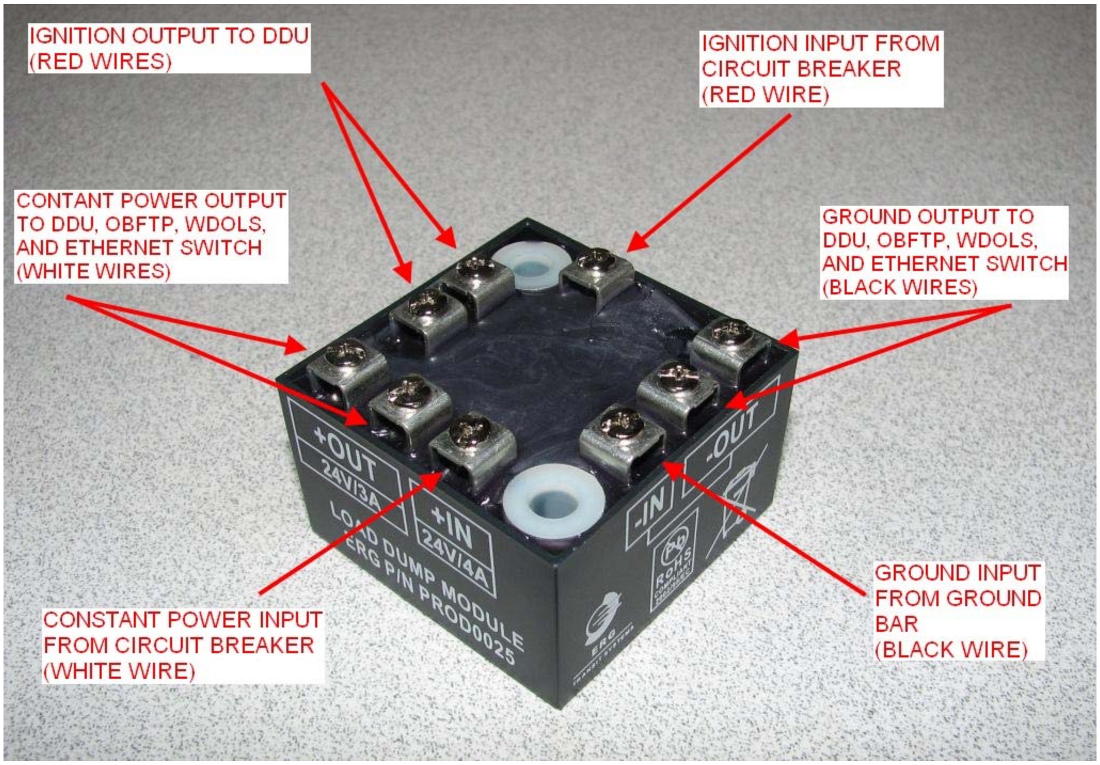

Figure 13: Wiring Diagram of LDM

3.2 Installing the DDU Cables

3.2.1 Installing the DDU Power Cable and Ethernet

1. Run the power and Ethernet cable through the solid loom from the DDU bracket underneath the dash following existing cables (see Figure 14). Continue to route cables underneath the dash (Figure 15) and down to the power compartment. See Figure 16 for power cable routing in the power compartment outside the bus.

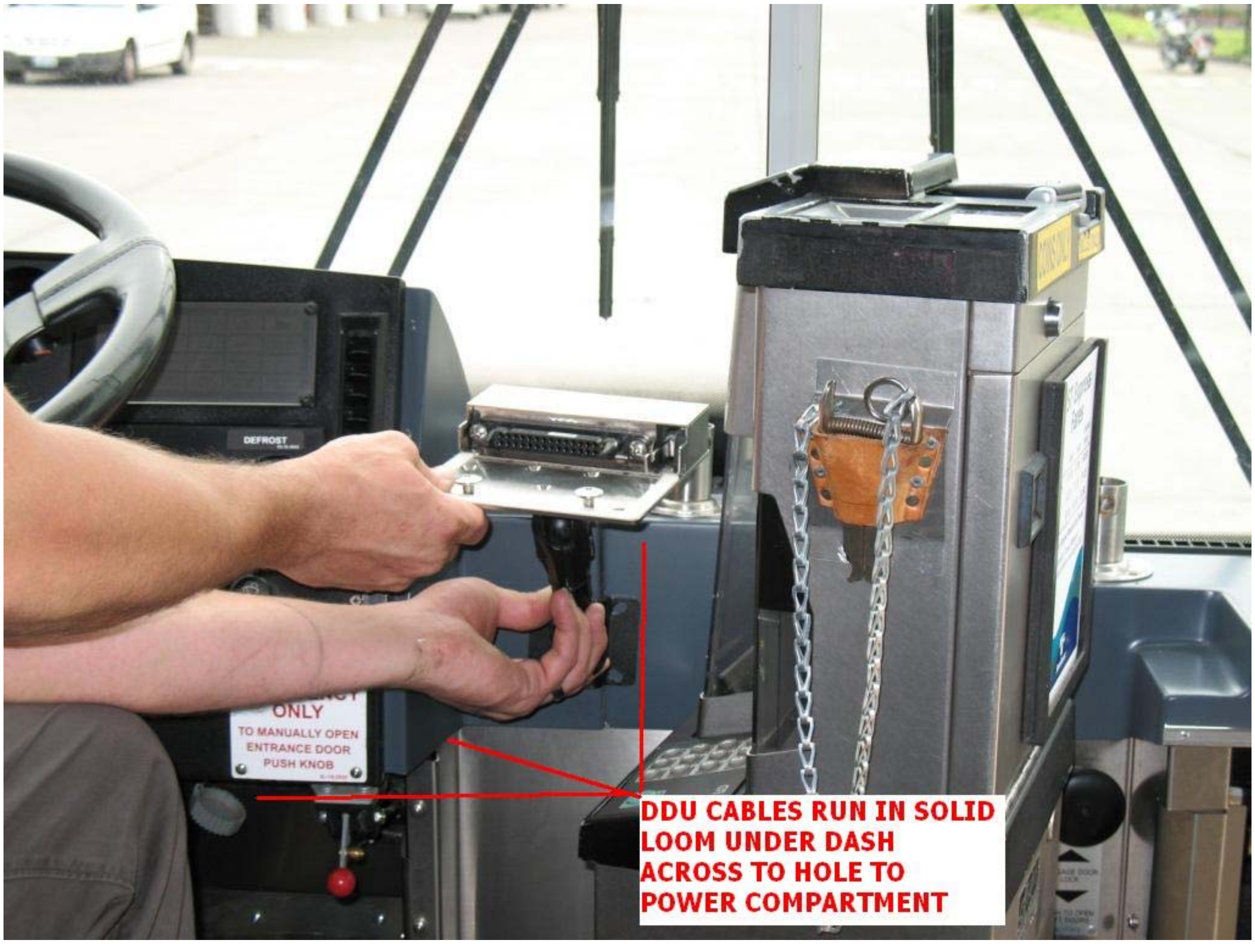

Figure 14: DDU Power and Ethernet Cable Routing

2. The cables should be visible from the outside of the bus. The power cables follow existing cable routes across to the LDM. The Ethernet Cable routes to the switch.
3. Terminate the power cables to the LDM using ring terminals. See Figure 13 for connection detail.
4. Terminate the power and Ethernet cables at the DDU cradle as described in SEA-02088 Generic On-Board Installation Instruction [2].

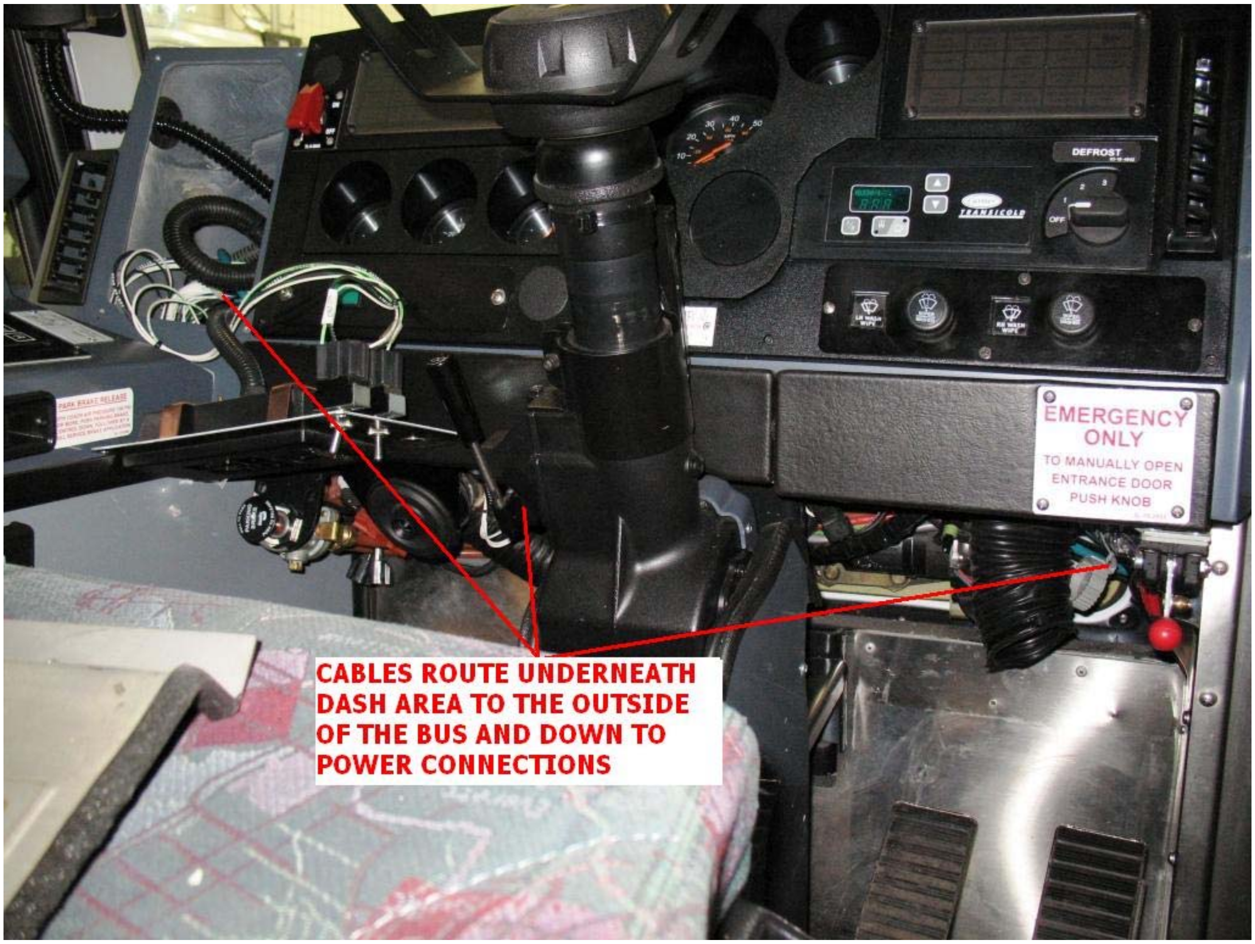
CABLES ROUTE UNDERNEATH DASH AREA TO THE OUTSIDE OF THE BUS AND DOWN TO POWER CONNECTIONS
EMERGENCY ONLY
TO MANUALLY OPEN ENTRANCE DOOR PUSH KNOB
DEFROST

Figure 15: Power and Ethernet Cable Route Underneath Dash

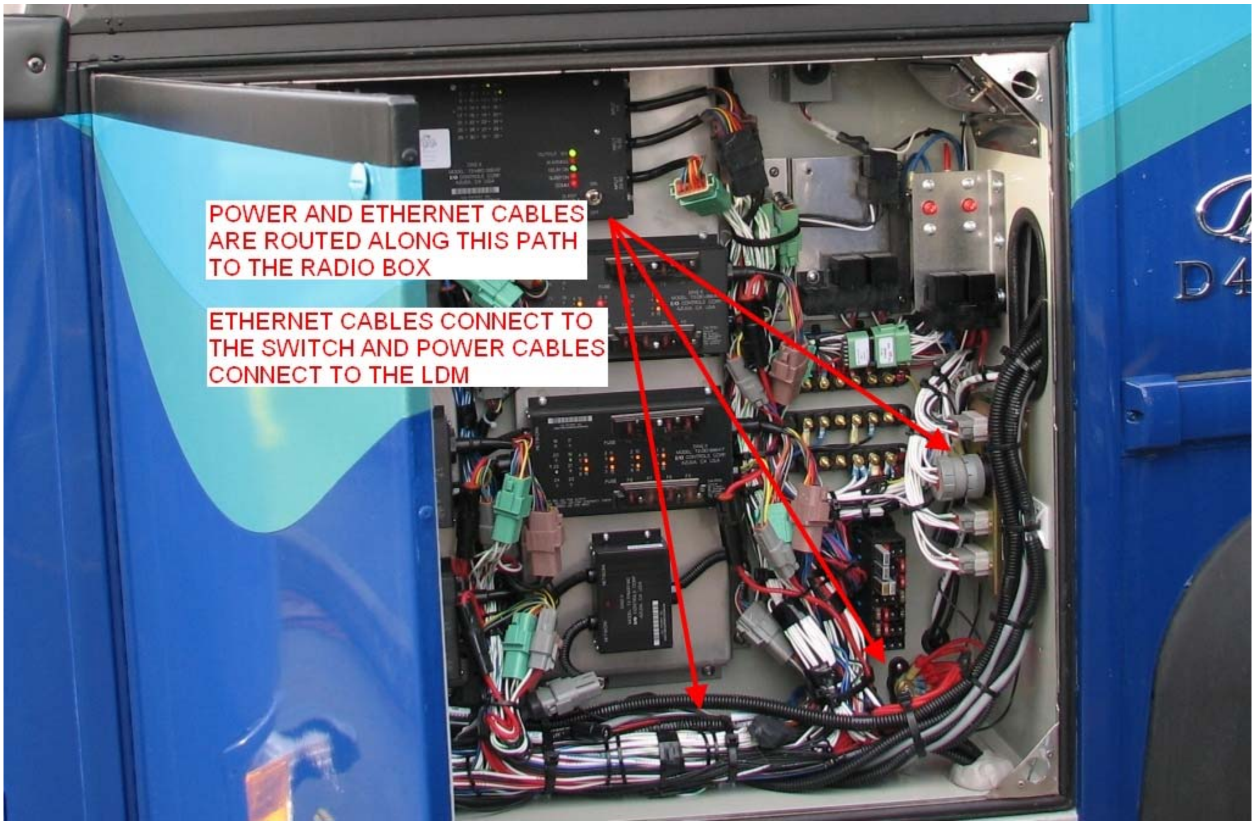
POWER AND ETHERNET CABLES ARE ROUTED ALONG THIS PATH TO THE RADIO BOX
ETHERNET CABLES CONNECT TO THE SWITCH AND POWER CABLES CONNECT TO THE LDM

Figure 16: Power and Ethernet Cable Routing Outside Bus

3.3 Installing the OBFTP Cables

As described in Section 2.2, the cables should be run for the OBFTP before the vertical stanchion and OBFTP bracket are secured to the base clamp. The power and Ethernet cables run from the OBFTP and join the DDU power and Ethernet cables. The cables then run along existing cable routes to the power distribution panel and into the Radio Box (see Figure 17).

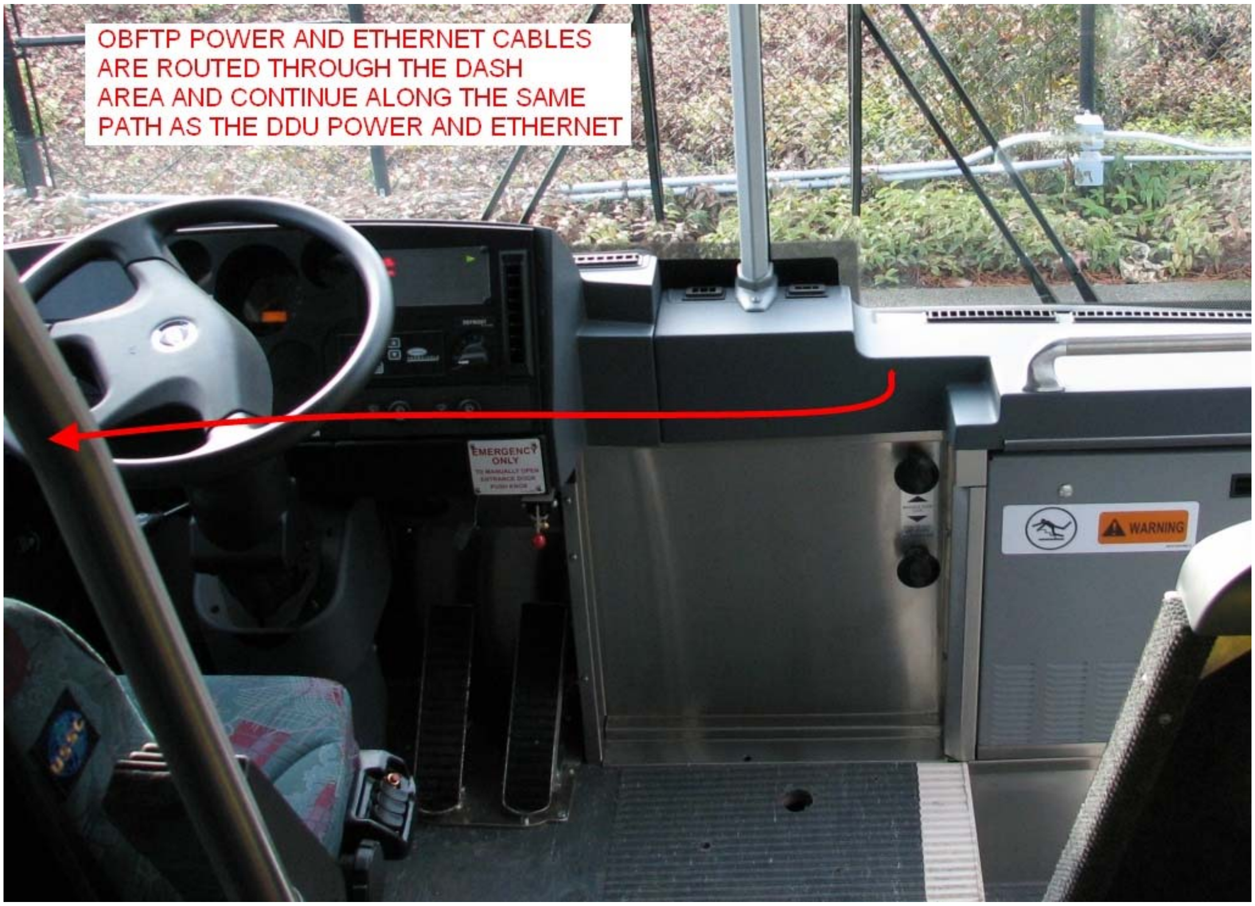
OBFTP POWER AND ETHERNET CABLES
ARE ROUTED THROUGH THE DASH
AREA AND CONTINUE ALONG THE SAME
PATH AS THE DDU POWER AND ETHERNET
EMERGENCY ONLY
WARNING

Figure 17: OBFTP Cable Route

3.3.1 Installing the OBFTP Power and Ethernet Cables

1. Route the OBFTP power and Ethernet cables through the hole in the base clamp and into the dash cavity.
2. Route the cables underneath the steering wheel to join the DDU cables and run along existing cable routes behind the gauges.
3. Run the power cable to the Radio Box and terminate to the LDM with ring terminals (see Figure 13).
4. Run the Ethernet cable to the Radio Box and terminate to the switch.
5. Fit the OBFTP clamping bracket to the vertical post.
6. Terminate the power and Ethernet cables in the OBFTP cradle as described in SEA-02088 Generic On-Board Installation Instruction [2].

3.4 Installing the WDOLS and Ethernet Switch Cables

Run the power cable for the WDOLS and Ethernet Switch from the LDM. One cable from the LDM supplies power for both the Ethernet Switch and the WDOLS. A short Ethernet cable is used to join the Ethernet Switch to the Cisco Power Injector.

The Ethernet cable is three feet long and connects from the Ethernet Switch to the Cisco Power Injector.

3.4.1 Installing the Power and Ethernet Cables

The power cable should begin at the LDM and follow existing Ethernet cables already laid for the DDU and the OBFTP that go to the switch.

1. SEA-02088 Generic On-Board Installation Instruction [2] describes how to correctly terminate the WDOLS cabling. Please refer to that document for full details.
2. Cut three feet of Ethernet cable and terminate to the above specifications.

3.4.2 Installing the Antenna Cable

After the antenna is installed, route the cable from the overhead access panel through the vertical duct behind the driver. The cable will then join the existing DDU and OBFTP power and Ethernet cables. The antenna cable will continue into the Radio Box where it will be terminated and connected to the Cisco 1310 Access Point. See Figure 18 and Figure 19.

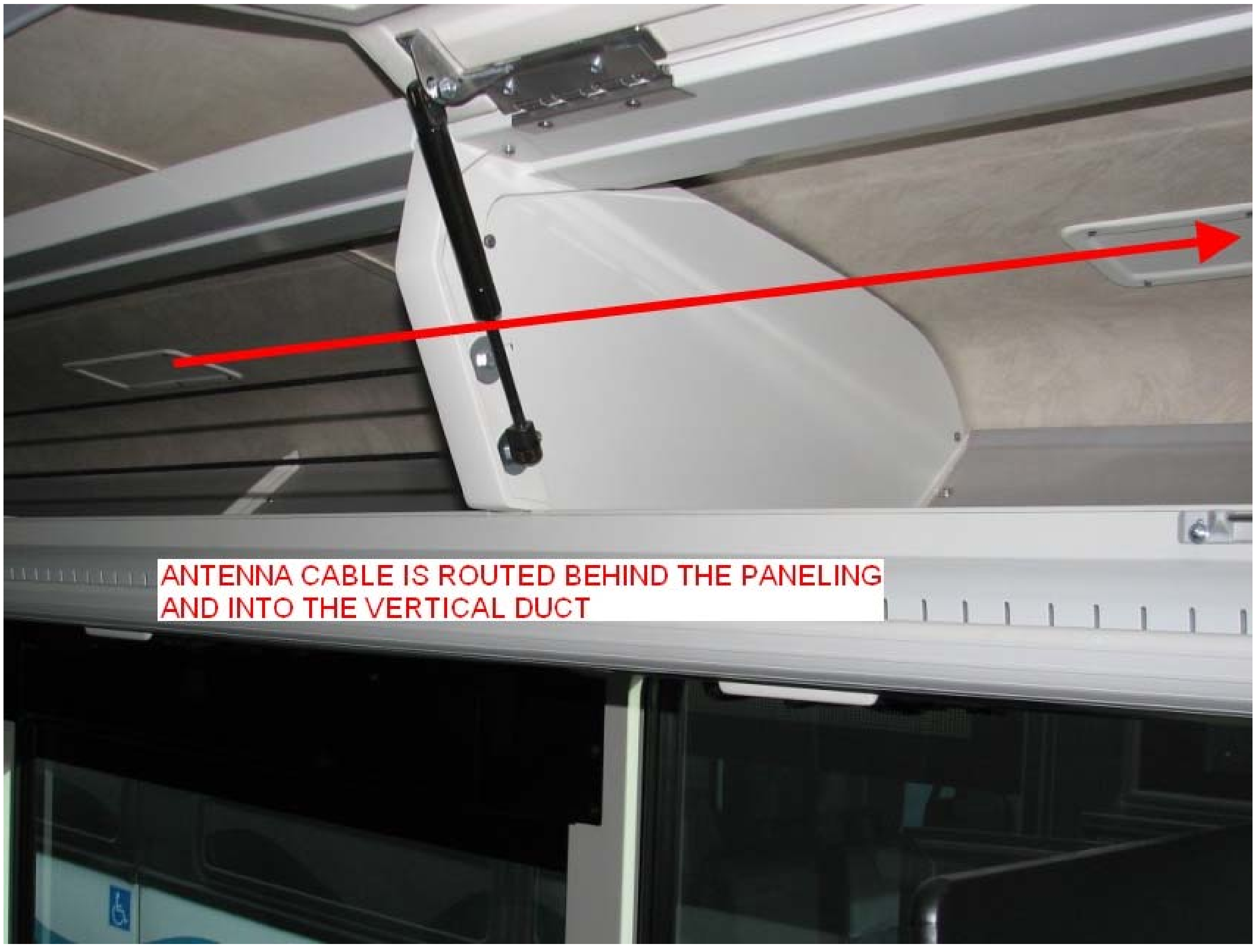
ANTENNA CABLE IS ROUTED BEHIND THE PANELING
AND INTO THE VERTICAL DUCT

Figure 18: Antenna Route (luggage compartment)

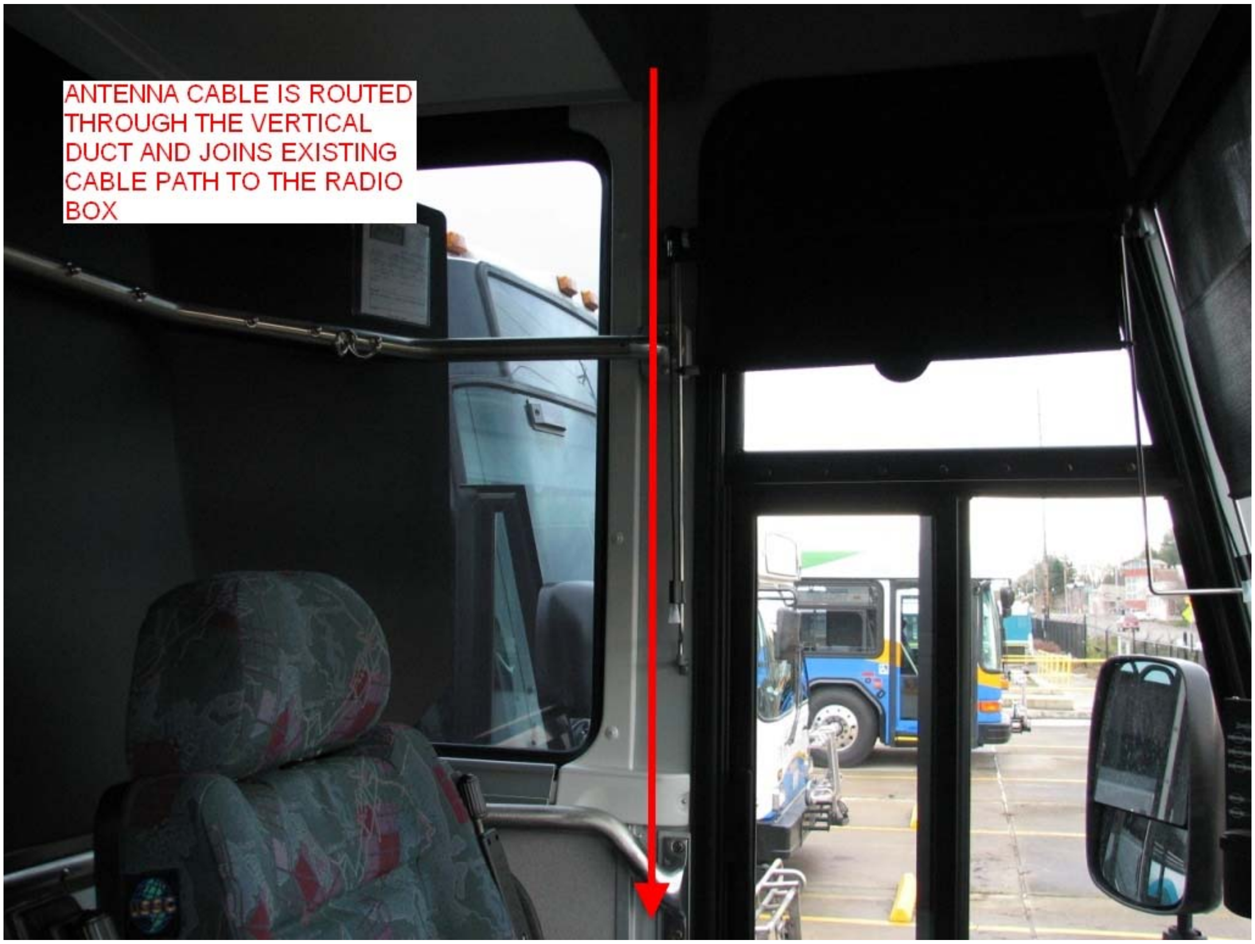
ANTENNA CABLE IS ROUTED THROUGH THE VERTICAL DUCT AND JOINS EXISTING CABLE PATH TO THE RADIO BOX

Figure 19: Antenna Route (vertical duct)